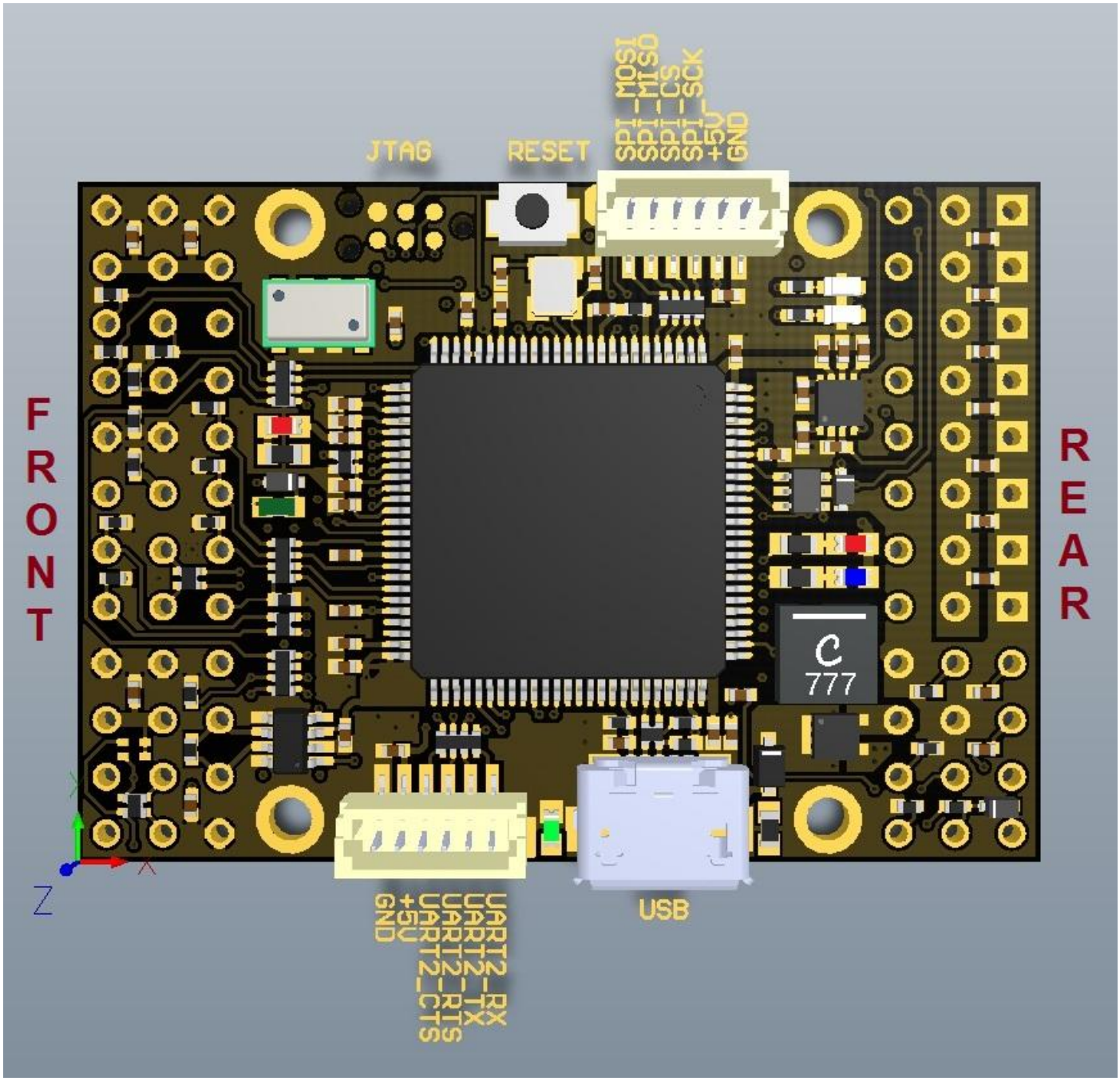
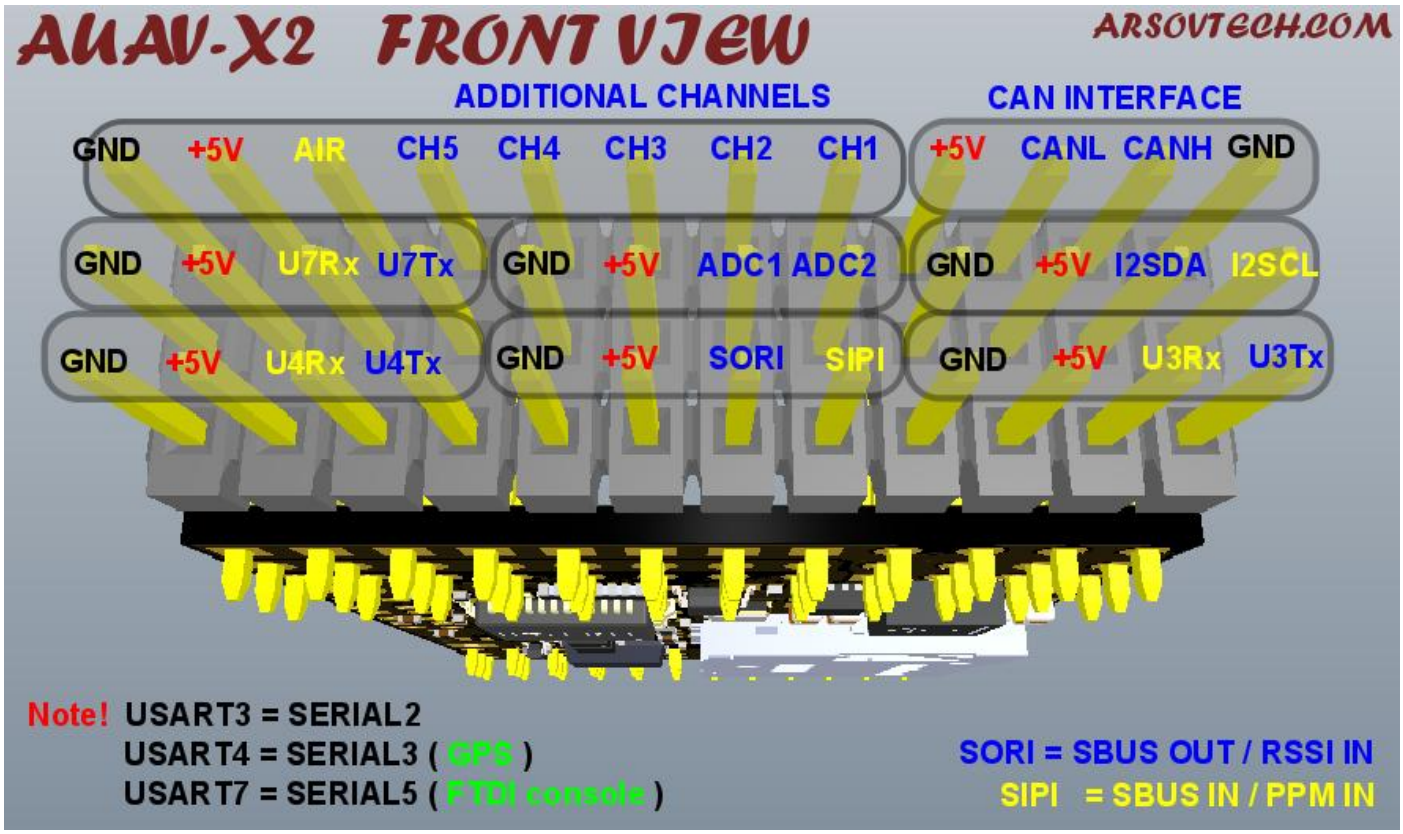
SPECIAL THANKS to PHILLIP KOCMOUD, MARK WHITEHORN and LORENZ MEIER

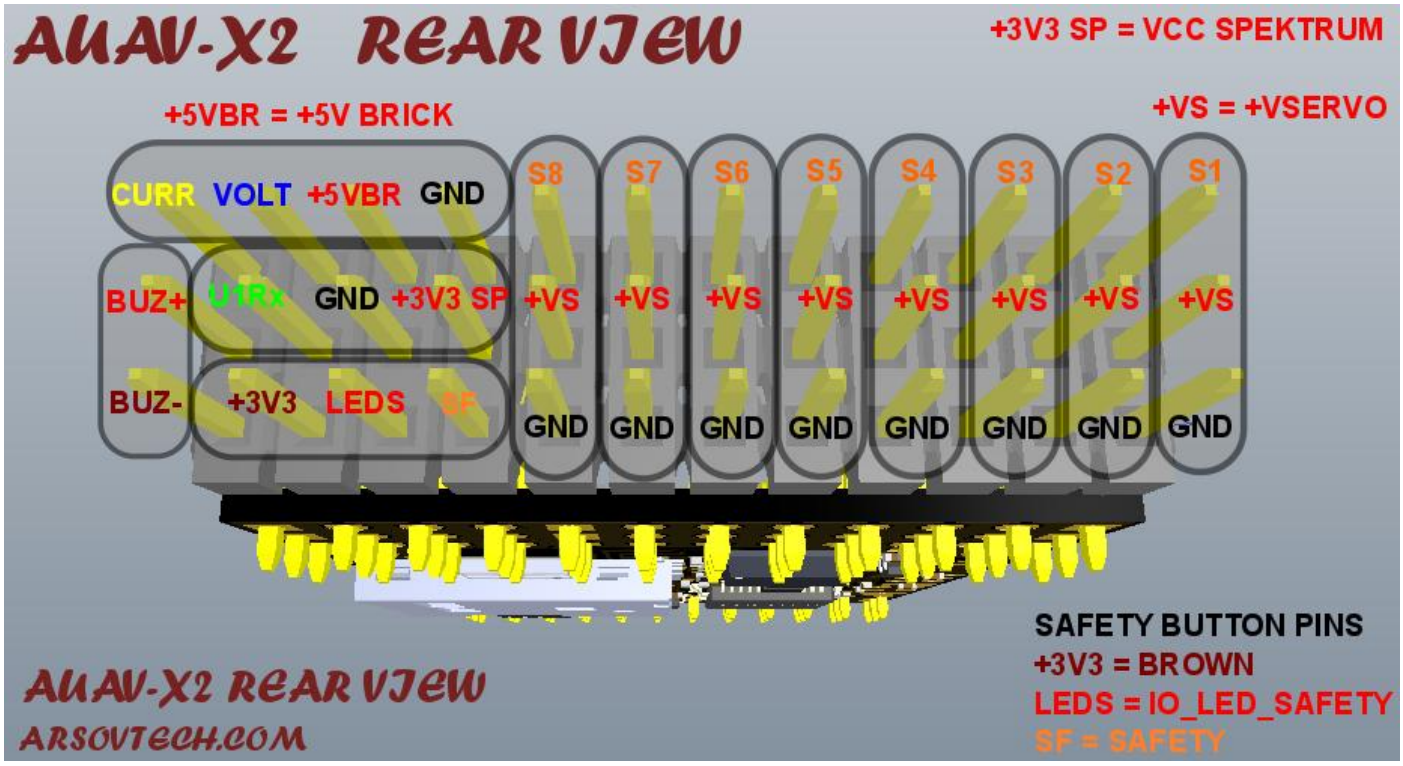
A/ AUAV-X2 basic views



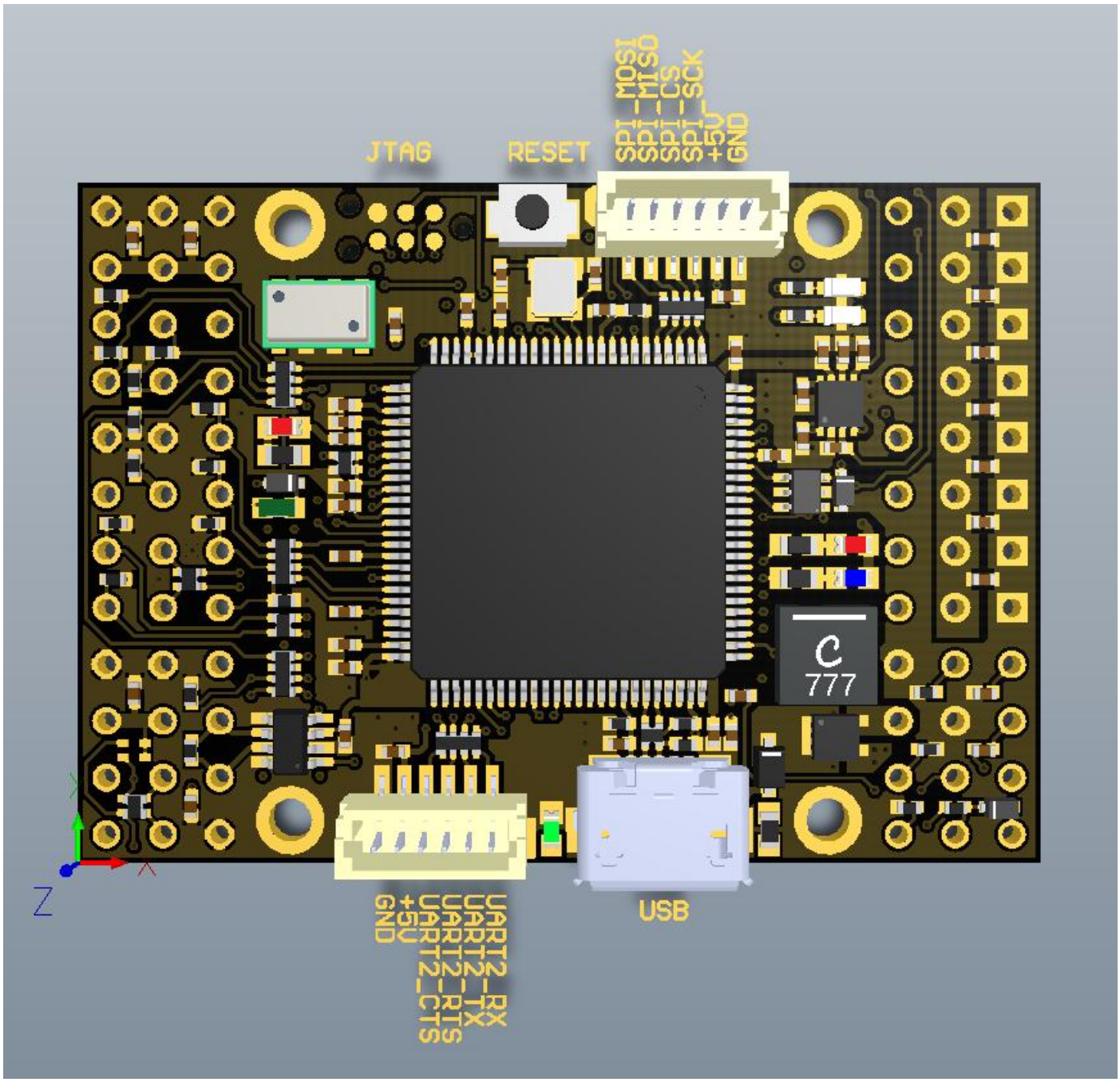
FRONT HEADERS



REAR HEADERS

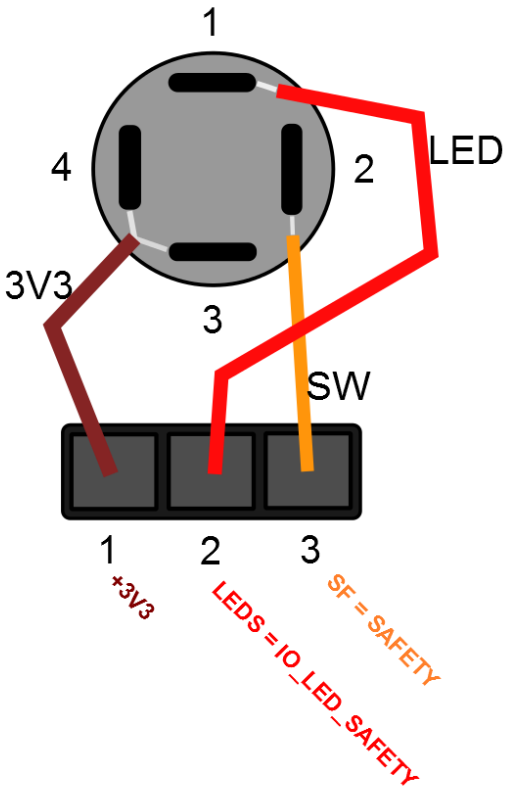


SIDE HEADERS



SAFETY BUTTON CONNECTIONS

SAFETY BUTTON BACKSIDE VIEW



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1. **FRONT HEADERS**

a/ ADDITIONAL CHANNELS

CH1 to CH5 are additional FMU channels, which could be used for anything, but for using them, the user should add his own code to the firmware. These additional channels could be used for PWM inputs, general purpose inputs or outputs, or analog inputs.

AIR, +5V and GND are the airspeed sensor pin set, where AIR is the analog input from the airspeed sensor, +5V and GND are used for powering an analogue airspeed sensor.

b/ CAN INTERFACE

GND, CANL, CANH and +5V are pins for interfacing CAN bus.

c/ USART7 (SERIAL5)

GND, +5V, U7Rx and U7Tx are pins for interfacing the SERIAL5, used by default as FTDI console interface.

d/ USART3 (SERIAL2)

GND, +5V, U3Rx and U3Tx are pins for interfacing the SERIAL2, a general purpose serial interface.

e/ USART4(SERIAL3)

U4Tx, U4Rx, +5V and GND are pins for interfacing the SERIAL3, used by default as GPS interface.

f/ ANALOG CHANNELS – ADC1 and ADC2

GND, +5V, ADC1 and ADC2 are pins for interfacing the analog inputs.

NOTE! The full ADC voltage span should be within 3.3VDC.

If you need to measure higher voltages, please calculate a R-R divider !

g/ I2C1 INTERFACE

I2SCL, I2SDA, +5V and GND are pins for interfacing the I2C1 interface.

NOTE! Both SCL and SDA have internal 2k2 pullups to +3.3V.

h/ SBUS / PPM INTERFACE

GND, +5V, SORI (SBUS OUT / RSSI IN) and SIPI (SBUS IN / PPM IN) are pins for SBUS or PPM interfaces. The SIPI input has protection in case of back EMF from receiver in case it has additional servos connected to and powered from additional ESC.

NOTE! If you need to connect additional servos/ESCs to the receiver and to avoid back EMF from it, you should use one of the following connection approaches:

Additional servos connected to the receiver:

a/ disconnect the +5V power from X2 to the receiver-use just SIGNAL and GND;
b/ power the receiver from additional 5V source (ESC).

Additional ESCs connected to the receiver – you have 2 options:

a/ disconnect all ESC +5V RED cables from the receiver and power the receiver from the autopilot as by default. Use just SIGNAL and GND from ESCs;
b/ disconnect the +5V from the autopilot, and power the receiver from JUST ONE of the ESCs. Disconnect all other ESC +5V RED cables from the receiver.

2. REAR HEADERS

a/ SERVO HEADERS

S1 to S8 are the signal pins, +VS (+VSERVO) is the servo power supply rail, and GND is the GND rail.

NOTE! Please use just one ESC/BEC for powering the servo rail with voltage between 4.5VDC and 10VDC for regular AUAV-X2 version and 5.0VDC and 5.5VDC for AUAV-X2q ! Also don't forget that the servo bus operates at 50Hz for fixed wing and 400Hz in multirotors!

b/ POWER BRICK

GND, +5VBR, VOLT, CURR are respectively GND, Vcc BRICK , voltage sensing and current sensing.

NOTE! VCC BRICK can be between 4.5VDC and 10VDC for regular AUAV-X2 version and 5.0VDC to 5.5VDC for AUAV-X2q!

Voltages from VOLTAGE and CURRENT sensing should be 3.3VDC max!

c/ BUZZER CONNECTOR

BUZ+ and BUZ- are pins for connecting the buzzer.

NOTE! Please connect the buzzer supplied with + and – and colors as of the picture!

d/ SPEKTRUM CONNECTOR

U1Rx, GND and +3V3 SP are respectively SIGNAL (YELLOW or GRAY), GND (BLACK) and power supply for SPEKTRUM receiver/satellite (RED).

e/ SAFETY BUTTON CONNECTOR

+3V3, LEDS and SF are respectively the safety button 3.3V power supply, LED signal and button contacts.

NOTE! Please connect the supplied button with the connector colors as of the rear headers picture! The safety button female cable colors must correspond to the picture colors!

3. SIDE HEADERS

a/ USART2 (SERIAL1) HEADER

USART2 (SERIAL1) is a full set serial interface :

Pin1 = GND

Pin2 = +5VP (+5VDC from power supply for peripherals)

Pin3 = U2CTS

Pin4 = U2RTS

Pin5 = U2Tx

Pin6 = U2Rx

The header for USART2 (SERIAL1) is not soldered, but supplied in the AUAV-X2 package. This serial interface could be used for telemetry.

b/ EXTERNAL SPI INTERFACE

Pin1 = GND

Pin2 = +5VP (+5VDC from power supply for peripherals)

Pin3 = SCK (SPI clock)

Pin4 = SS (Slave Select)

Pin5 = MISO (Master In Slave Out)

Pin6 = MOSI (Master Out Slave In)

4. JTAGs

There are two JTAG interfaces – FMU one over the FMU side and IO over the IO side. Both use the same leading holes and are designed to work with TC2030 Tag connector (http://www.tag-connect.com/TC2030-IDC-NL).

Very useful device for debugging is the Black Sphere Debugger (http://www.tag-connect.com/BLACK-SPHERE-DBG).

For flashing the bootloaders, firmware and debugging, the cheap STM32 Nucleo board could also be used (http://mbed.org/platforms/?tvend=10).

The AUAV-X2 boards are supplied with both FMU and IO bootloaders flashed, so one doesn't need to flash them again.

5. LEDS and SAFETY SWITCH

There are 4 LEDs on the X2 board – FMU status LED (RED), IO status LED (RED), Power LED (GREEN) and the GPS / Position LED (BLUE).

LED STATUS TABLE

GREEN = Power LED = always ON

BLUE = Heartbeat LED

2Hz Blink - Heartbeat Loop Running

Solid - Uploading new firmware for IO (red LED should be solid or blinking unevenly)

FMU RED LED (ARMING LED)

SLOW BLINK = Ready to arm (System self tests are OK)

FAST BLINK = Refusing to arm (System self tests are NOT OK)

SOLID = Armed

IO RED (FAILSAFE LED)

FAST BLINK = Bootloader active (the BLUE LED should be off in this state)

4Hz = No FMU input

ON = Initialization error, check your RC config options in your parameters

OFF = System is OK

SAFETY SWITCH STATUS

ON = FMU and IO are ARMED

SLOW BLINK = Ready to arm

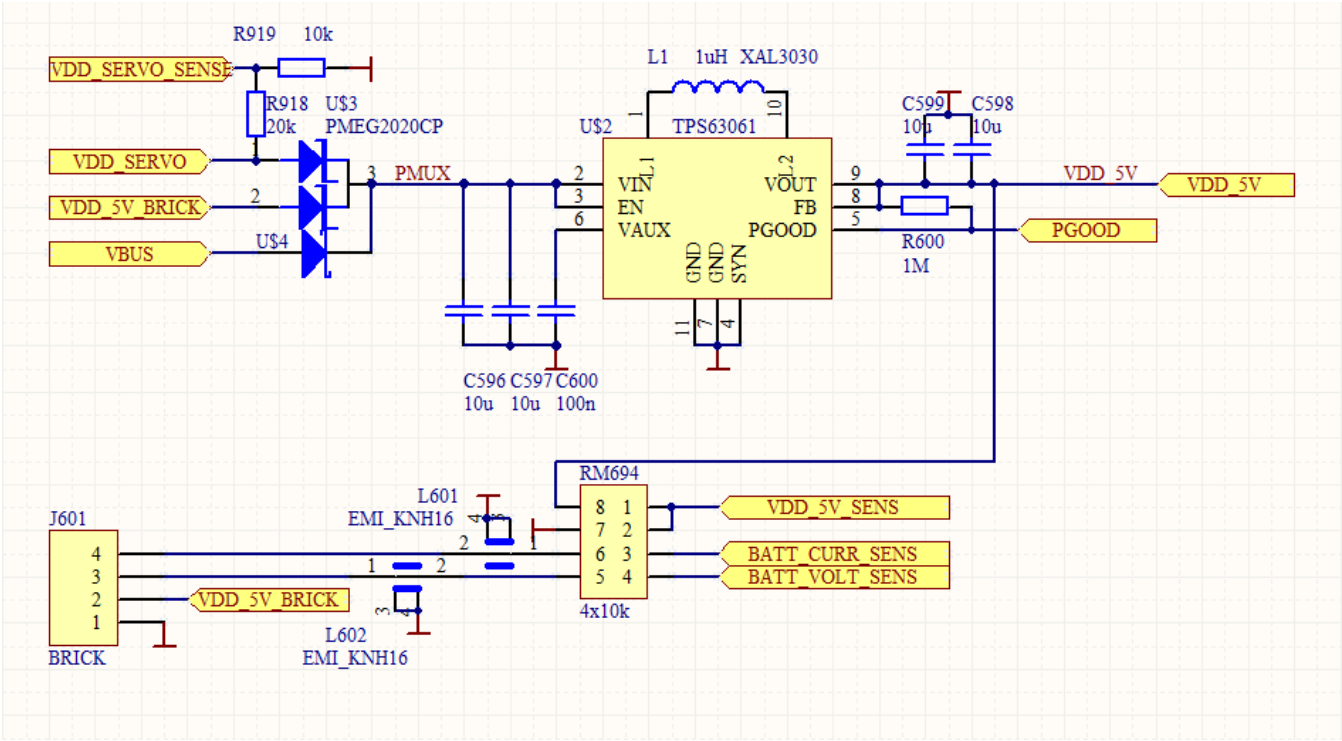
FAST BLINK = Error / Refusing to arm

LONG OFF with FAST DOUBLE BLINK = IO armed, but FMU not

LONG OFF with FAST QUAD BLINK = FMU armed, but IO not

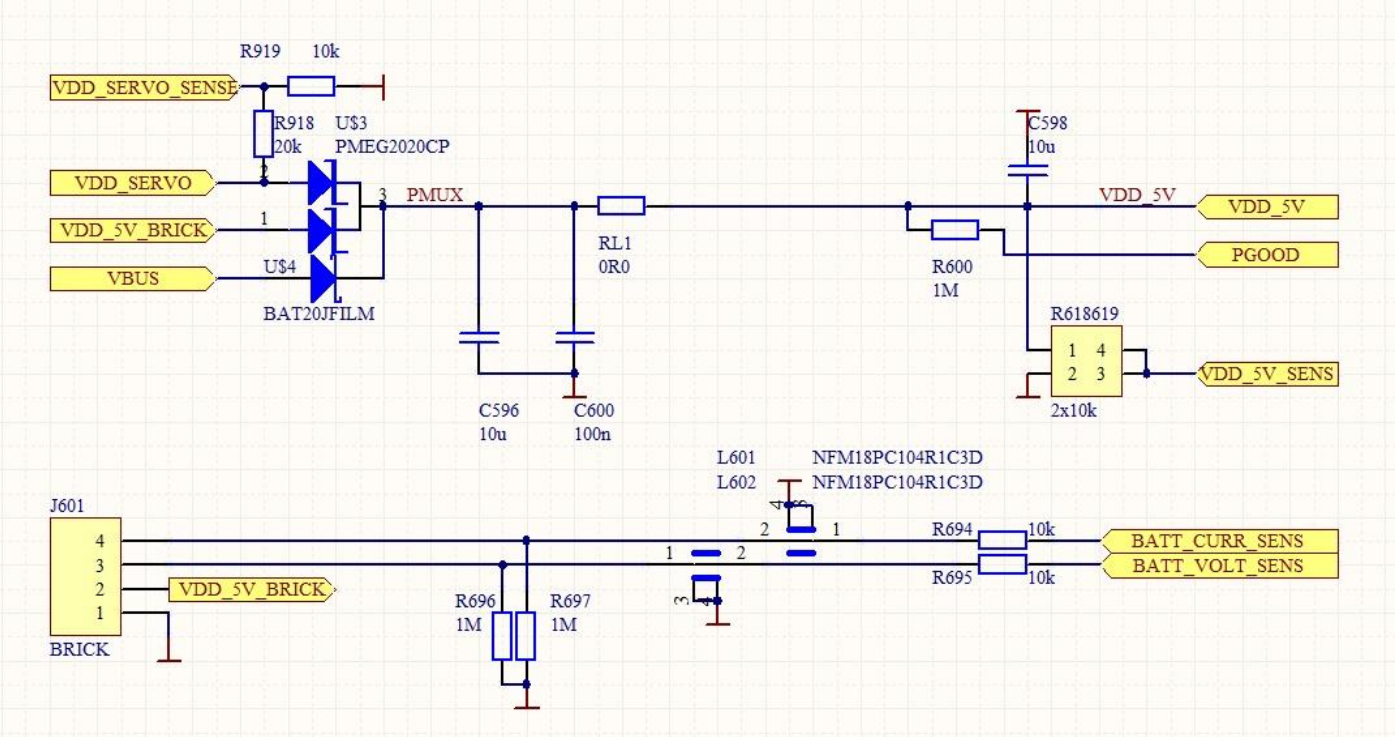
6. POWERING AUAV- X2

There are three power inputs – USB (only for programming and testing), Power from the Power Brick and Servo Power Bus. Here is the schematics of the X2 regular power stage:



As seen from the schematics, the servo power bus is separated from the Brick Power and from the USB, by very low Vf Schottky diodes. PMEG2020CP has very low Vf…just a few hundred millivolts.

AUAV-X2Q version power supply:



NOTE! The Power Brick voltage and the Servo Bus voltage must be between 4.5VDC and 10VDC for regular AUAV-X2 version and 5.0VDC to 5.5VDC for AUAV-X2q!

NOTE! The MicroSD card socket acts also as a heatsink for DC-DC Buck-Boost regulator. It doesn't dissipate much heat, BUT never cover it with heat insulating materials. Also DO NOT cover any of the other heat dissipating components (LDO regulators and the STM32F4 processor)!

VERY IMPORTANT NOTE! THE MAX ALLOWABLE TOTAL CURRENT CONSUMPTION FOR ALL PERIPHERALS IS 500 mA!

ALWAYS ALLOW AIR CIRCULATION OVER BOTH AUAV-X2 SURFACES!

7. UPLOADING THE FIRMWARE

a/ DOWNLOAD and INSTALL QGroundControl from :

http://qgroundcontrol.org/downloads

Install an empty FAT16 or FAT32 formatted MicroSD card into the AUAV – X2 MicroSD card socket. Connect the AUAV – X2 to the PC via USB-MicroUSB cable.

In QGroundControl, click in the top left on **CONFIG**, then on the big green **SCAN** button.

After the board has been found, click on the **FLASH** / **UPGRADE** button to upgrade the firmware.

Disconnect the USB cable from the PC, hold the safety switch pressed while powering on the system. Release the button. The IO RED boot LED will flash rapidly. The AUAV – X2 will boot normally. It will automatically upgrade the backup processor firmware.

A quick tutorial video can be found here.

b/ AIRFRAME CONFIGURATION

Choose the Airframe Configuration from **CONFIG** menu. Choose your configuration and hit **Apply and Restart** button. The autopilot will restart.

c/ SENSOR CALIBRATION

Choose Sensor Calibration. Place the autopilot on a flat surface and don't move it. Start with Gyro and Mag Calibration. For Accelerometer Calibration you need 3 perpendicular surfaces. You may use a cardboard box for. Use 3 of it's surfaces to place the autopilot steady. Follow the plane positioning guide. First place the board, hold and wait till the system beeps.

d/ RADIO CALIBRATION

Choose Radio Calibration from **CONFIG** menu. Follow the Radio Calibration procedure.

e/ TEST MANUAL MODE

First step to get ready for flight is to test manual (pass-through) mode. This is where you control the aircraft directly from your R/C transmitter.

While the system will enter the manual mode state when powered only by USB, it will NOT be able to drive the servos. You must connect a battery or a BEC (as described above) for the flight modes to function properly.

To test, you can just connect the BEC output (throttle connector) from your ESC or some other sufficient 5V source to the servo bus.

f/ MANUAL MODE

Make sure you have completed airframe settings and calibrations first (radio and sensors).

Enter manual mode as follows:

- Start QGroundControl (optional)
- Turn on your R/C transmitter
- Connect the battery/BEC power source
- Connect the USB to your computer (optional)
- Hold down the safety switch (it should be doing a double blink)
- Hold transmitter stick at Throttle minimum (down) and YAW/Rudder full right
- You should hear the audio alarm for ARMED and the safety switch is solid green
- You should now be able to move the sticks/levers and see the servo move
- If you are having trouble, re-do the R/C calibration in QGroundControl

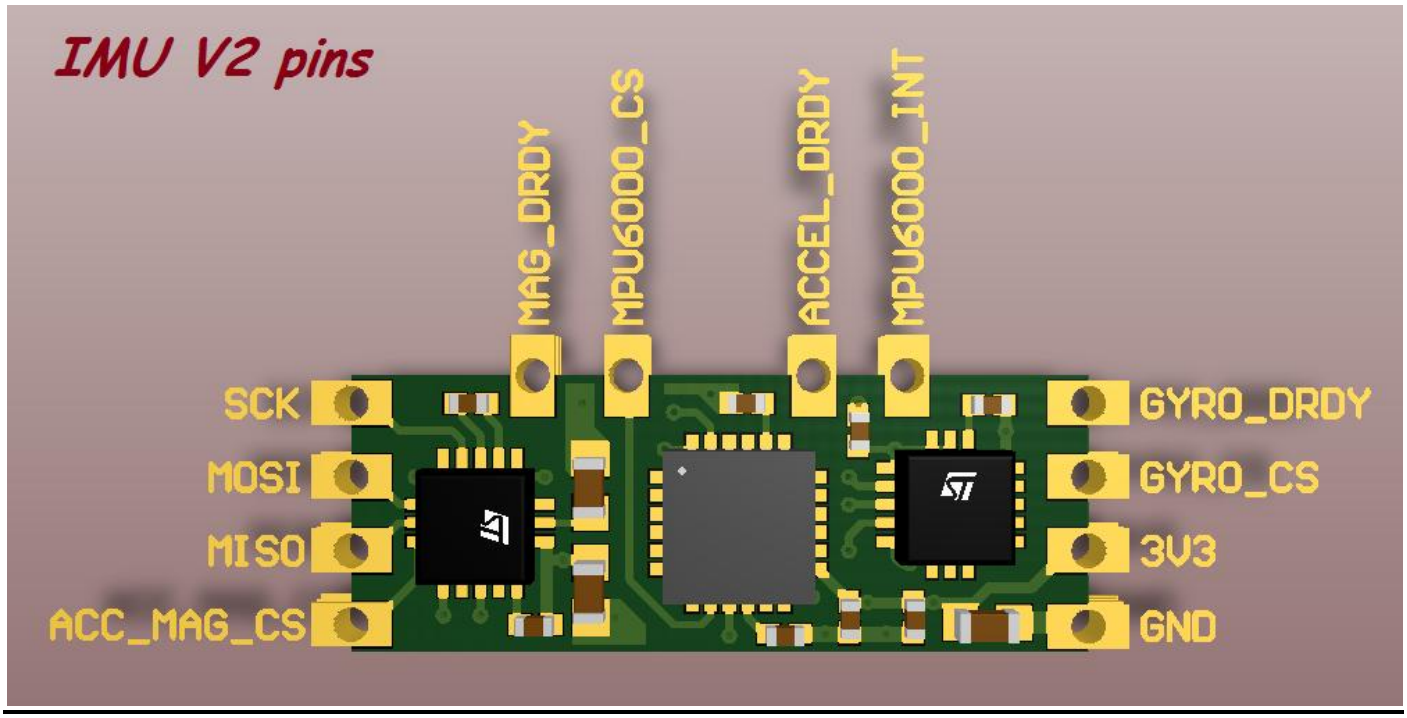
g/ TELEMETRY on AUAV-X2

First you need to prepare the cable. To prepare the cable, you just need a crimp pliers to crimp the pins supplied to the cables. You have to choose color #24-26 AWG cables. The colors you need are – BLACK for GND, RED for +5V, YELLOW for RTS, GREEN for TxD, ORANGE for RxD and BLUE for CTS for example, but you could use other colors for.

NOTE! THE TELEMETRY IS ON UART2 !

More on how to connect the telemetry you can read here .

8. MICRO IMU V2 PINOUTS



9. SOME VERY GOOD REFERENCES

AUAX-X1 GITHUB - https://github.com/pkocmoud

PX4/PIXHAWK - http://pixhawk.org/

ARDUPILOT - http://ardupilot.com/